PROF. A. L. LOWELL, professor of political science in Harvard University, has been selected to succeed Dr. Eliot as president of the University. Prof. Lowell was born in Boston in 1856, and represents a family which has been prominent in Massachusetts affairs for a century.

A REUTER message from Berlin states that a professorship of aëronautics has been instituted at Göttingen University. The Minister of Education has appointed Prof. Prandtl, professor of applied mechanics at Göttingen, to lecture on the whole field of aëronautics.

CAPTAIN H. G. LYONS, F.R.S., Director-General of the Survey of Egypt, has been appointed lecturer in geography at the University of Glasgow from the beginning of the next academic year. Captain Lyons, who was vice-president of the geographical section of the British Association last year, has also been appointed by the West of Scotland Provincial Committee to be lecturer in geography to teachers in training.

As an instance of practical science at universities, the New York correspondent of the *Times* states that the Columbia Wireless Club, composed of students of the scientific department, will soon be prepared to inaugurate inter-collegiate wireless telegraphy with the students of Princeton University, New Jersey, and with the University of Pennsylvania. The novel experiments will be watched with interest as a method of teaching practical developments of science.

THE Board of Education has issued as a Blue-book (Cd. 4440) the reports from those universities and university colleges in Great Britain which participated in the Parliamentary grant for university colleges in the year 1906–7. The present volume is the first of a series in which all the reports in any one volume relate to the same academical year. It is much to be regretted that the Board of Education makes no attempt to collate the particulars provided concerning the seventeen institutions participating in the annual grant, which now amounts to 100,000*l*. It is at present a long and tedious process to compare, say, the income, the endowments, number of staff, and students of one institution with those of another. The arrangement of the volume, in fact, compares very unfavourably with the similar report of the U.S. Commissioner of Education published at Washington. The Board of Education may earn very easily the gratitude of students of the progress of higher education in this and other countries by including in the report of next year a series of tables summarising and comparing the educational condition of things in the universities and university colleges here concerned. It would then prove possible to understand more precisely why certain institutions are selected to receive a Treasury grant while others are precluded. For instance, we have before us the report for the session ending in August last of the East London College, which the Senate of the University of London recognises as a school of the University. The Treasury appears to be the only body which as yet has not accorded full recognition to the East London College of its status as the University College for East London. During the session 1905–6 the governors made a formal application for the college to participate in the Treasury grant. The inspectors appointed by the advisory committee of the Treasury visited the college and a favourable report was published. Yet no grant was awarded. If the tables suggested were available, it might be easier by careful comparison to understand this and other decisions. At present it is possible only to puzzle over the question. The number of students of university standing, the number of university successes, and the output of research work at the East London College seem to compare favourably with those of several of the university colleges receiving grants.

THE annual meeting of the Mathematical Association was held at King's College, London, on January 12. The association now consists of 496 members, representing an increase of more than 20 per cent. on the preceding year. The year which has just ended has been characterised by unusual activity. The formation of local branches has for many years been considered desirable, and a first move in this direction has been made by the formal recognition of a North Wales branch under the local secretaryship of Mr. T. G. Creak, of Llanberis. The association has appointed representatives on a joint committee with the Public Schools Science Masters' Association to consider the best means of coordinating teaching in mathematics and science. Dr. Bovey, F.R.S., read a paper on the mathematical training of technical students, in the course of which the necessity was pointed out of teaching such students to realise the value and utility of the theoretical training which they were receiving. Dr. Bovey considered the influence of the teacher, the text-book, the mental powers of the student, and carefully planned courses. The question further arose as to whether the teaching of technical students should be in the hands of mathematicians or engineers. While favouring the latter choice, Dr. Bovey quoted the opinion expressed by Prof. Slichter, who considered that the most competent teacher should be an engineering graduate, but that it would be necessary for him to have at least three years of post-graduate study in advanced mathematics. It was, however, impossible to induce graduates of technical schools to give this amount of time to preparation for instructional work when other fields of work offered such far better and more immediate prospects. Dr. Bovey thinks that in these circumstances the best plan at present is to secure an excellent mathematician, and to induce him to fit himself for the post by making himself in some degree familiar and sympathetic with the engineer's point of view and with the class of problems with which his students will have to deal in after life. Papers were subsequently read by Prof. Alfred Lodge on homography and cross-ratio, and by Prof. Bryan on the need of a new symbol, in approximate calculations, to denote digits the values of which are unknown, and which at present are represented by zeros. In his retiring address the latter directed attention to the serious danger of the extinction of the English mathematical specialist, and the necessity of fighting against this tendency. Engineers and others had plenty of problems for which all the resources of the mathematician were needed, but the latter found that this work interfered with his means of earning a livelihood. In defending the specialist against the attacks of the outside public—attacks essentially peculiar to Great Britain—Prof. Bryan pointed out that men who had specialised in part ii. of the mathematical tripos were prominently to the front on all committees appointed by the association for reforming mathematical teaching on common-sense, practical lines.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, Received August 10, 1908.—"Reciprocal Innervation of Antagonistic Muscles. Twelfth Note. Proprioceptive Reflexes." By Prof. C. S. **Sherrington**, F.R.S.

Whereas most reflexes are excited by environmental changes acting directly as agents on the receptive organs, by proprioceptive reflexes are meant reflexes excited habitually by the organism acting as agent upon itself, and thereby applying its own organs or parts as stimuli to its own nerves. In propioceptive reflexes the organism applies itself as a stimulus to itself. By its own act and in its own substance it excites one or more of its own receptor organs. In the bending of the knee, the organism, by executing the movement of a part of itself, supplies by that means an alteration of the condition of that part, and so stimulates certain reflex arcs, propioceptive arcs, arising in that part. The reaction thus excited is causally less directly related to the environment than are reflexes excited directly by the surrounding world. In other words, an important difference between propioceptive and other reflex reactions is that the former stand only in secondary relation to the external world, whereas the latter stand always in primary relation to it. One outcome of this is, as has been previously[1] pointed out, that the proprioceptive reflexes tend to ally themselves to, fuse with, and habitually reinforce other reflexes of exteroceptive and interoceptive origin.

It is shown in the present paper that the bending of

1 Sherrington, "Integrative Action of the Nervous System. (London and New York, 1906.)

the knee causes, by stretching the extensor muscle of the knee, a reflex inhibition of the contraction of that muscle; the muscle assumes, in consequence, a greater length. This reaction is termed in the paper "the lengthening reaction." It is shown that the afferent nerve of the extensor muscle itself is absolutely indispensable for this reaction.

Conversely, there is "a shortening reaction." When the extensor muscle is either passively or by its own active contraction shortened, there occurs a change in the reflex arc of the muscle itself which makes its tonic length less. The result is that a transient contraction of the muscle becomes prolonged by a persistence of the tonic contraction, and this latter is the shortening reaction which appends itself to the transient contraction, however induced. The shortening reaction is, like the lengthening reaction, brought about by the afferent nerve-fibres of the muscle itself; these in some way regulate and adjust the reflex tonus of the muscle. If the afferent nerve-fibres of the muscle itself are severed, the "shortening reaction" and the long, persistent after-contraction which it effects are entirely wanting in the reactions of the muscle. This is so whether the afferent fibres have been severed only a few days or for three months.

Attention is directed to the similarity between these proprioceptive reflexes of the extensor muscles as studied in cat and dog and the reactions observed by v. Uexküll and others in tonic preparations of various invertebrate muscle, *e.g.* the retractor muscle of Sipunculus. The similarity is close enough to leave little doubt that the phenomena achieve the same practical end.

Mathematical Society. January 14.—Sir W. D. Niven, president, in the chair.—The canonical form of a linear substitution: H. **Hilton.**—Researches concerning the solution of the quintic equation: J. **Hammond.**—Octavic and sexdecimic residuacity: Lieut.-Colonel A. **Cunningham.**—Change of the variable in a Lebesgue integral: Dr. E. W. **Hobson.**—Abel's extension of Taylor's series: Rev. F. H. **Jackson.**—Note on the evaluation of a certain integral containing Bessel's functions: Prof. H. M. **Macdonald.**

MANCHESTER.

Literary and Philosophical Society, December 15, 1908.—Prof. H. B. Dixon, F.R.S., president, in the chair.—The volatility of radium A and radium C: W. **Makower.** The experiments described were carried out with a view to determine the volatility of radium A, and also of re-determining that of radium C under different conditions to see whether the volatility of this product was influenced by its environment. The volatilisation point of radium A was found to be 900° C. Radium C was found to begin to volatilise at a temperature between 700° C. and 800° C. When deposited on a platinum or nickel surface the volatilisation was found to be complete at 1200° C., whereas when deposited on quartz the volatilisation was still incomplete even at 1300° C. The same result was found whether the deposit had been previously dissolved in hydrochloric acid or not. Finally, experiments were made to see whether radium C is charged at the moment of its production from radium B. Experiments in which the emanation exposed to an electric field was contained in a furnace at 950° C. failed to reveal any evidence of a charge carried by radium C.—Note on the production of white ferrous ferrocyanide: R. L. **Taylor.** A little solution of either hydrosulphurous acid or of sodium hydrosulphite, added to a solution of ordinary ferrous sulphate, frees the solution so completely from any trace of a ferric salt that it gives a pure white precipitate with potassium ferrocyanide, instead of the light blue precipitate usually obtained. The white precipitate rapidly turns blue when exposed to the air, and it is also instantly turned blue when ordinary tap-water is added to it, owing to the oxygen which is dissolved in the water. Water which has been previously well boiled to expel dissolved air does not alter the colour of the precipitate. Hydrosulphurous acid or sodium hydrosulphite will turn Prussian blue perfectly white.

January 12.—Prof. H. B. Dixon, F.R.S., president, in the chair.—The influence of light on the coloration of certain marine animals (Hippolyte, Wrasses): Dr. F. W. **Gamble.** The author gave an account of his work on the colour-physiology of Hippolyte (the Æsop-prawn), and of one of the common British wrasses (*Crenilabrus melops*). Hippolyte is a variably coloured prawn, each colour variety agreeing closely with the tint of the weed on which it is found, and upon which it feeds. Previous experiments made jointly by the author and Prof. Keeble have shown that this remarkable sympathetic coloration is in all probability not inherited—*i.e.* the colour varieties do not necessarily breed true, but that the harmonious motley exhibited by this varying species is the outcome of a very special colour adaptation undergone by each individual, and that the coloration is controlled largely by the colour of the weed at the time when the young prawn settles down upon it, after a brief free-living larval existence. The results of more recent researches by the author on this subject have shown that the amount of pigment in the larva varies, in all races but the green one, with that in the parent. The more there is of it in the parent, the more highly coloured is the offspring. Green parents, however, gave rise to three kinds of broods:—(1) highly coloured ones like those of brown parents; (2) pale ones; and (3) a mixed brood, containing coloured to colourless in the proportion of 3 : 1. Coloured light experiments yielded an unexpected result, namely, a complementary colour to that of the light employed. Thus, under the influence of green light for a month, Hippolyte lost its yellow pigment and became brilliantly scarlet, while under red light it became green. In both cases the animal at starting was of a transparent and almost colourless appearance. The value of this complementary colour production (which does not appear to have been recognised in animals previously) upon the problem of the coloration of Hippolyte was briefly discussed.

PARIS.

Academy of Sciences. January 11.—M. Bouchard in the chair.—The families of Lamé resulting from the displacement of a surface which remains invariable in form: Gaston **Darboux.**—A general method of preparation of the monoalkyl, dialkyl, and trialkyl-acetophenones: A. **Haller** and Ed. **Bauer.** The ketone (methyl, ethyl, or propylphenylketone) is dissolved in pure dry benzene, an equimolecular proportion of finely divided sodium amide added, and heated on the water bath until a clear solution is obtained. The alkyl bromide or iodide is added drop by drop to this solution. By this method the following ketones have been prepared and their properties given in detail:—trimethylacetophenone, ethyldimethylacetophenone, methyldiethylacetophenone, triethylacetophenone, methylethylpropylacetophenone, and allyldimethylacetophenone.—Dirichlet's series: Harald **Bohr.**—The double integrals of the first species attached to an algebraic variety: Francesco **Severi.**—A theorem on differentials: W. H. **Young.**—A particular critical point of the solution of the equations of elasticity in the case where the forces on the border are given: A. **Korn.**—The theory of the moon: H. **Andoyer.**—A dynamometer for testing motors with large angular velocity: M. **Ringelmann.** The defects of the Prony brake for testing high-speed motors are reviewed, and a new form of dynamometer described, by means of which the total energy furnished at each instant by the motor can be read off, and is at the same time recorded.—A formula for velocity applicable to propulsion in air: Alphonse **Berget.** A modification of a formula devised for the velocity of steam vessels. $V = C\sqrt[3]{\frac{F}{S}}$, where V is the velocity in myriametres per hour, F the horse-power, S the surface of maximum section of the balloon in square metres, and C the coefficient of utilisation. The latter is shown to vary between 3·0 and 5·0 for various types of steerable balloon.—The radiation of cerium oxide: M. **Foix.** Some experiments are cited in support of the theoretical relation given in an earlier paper.—A modification of the phonograph: M. **de Pezzer.**—Aqueous solutions of pyridine: E. **Baud.** The freezing points of aqueous solutions of pyridine varying in concentration from 5 per cent. to 100 per cent. are given. The densities and refractive indices of these solutions were also measured, and also the heat of solution of pyridine in a large excess of water. Only two hydrates of pyridine, with two and six molecules of water, are indicated by these

experiments.—Lævo-campholic acid: Marcel **Guerbet.** A good yield of this acid is obtained by heating *l*-borneol with dehydrated caustic potash in sealed tubes. The acid has a rotation $\alpha_D = -49{\cdot}1$.—The alkaline reduction of *o*-nitrodiphenylmethane: P. **Carré.** Reduction with zinc dust and caustic soda gives *o*-hydrazodiphenylmethane and *o*-aminodiphenylmethane.—The influence of aëration on the formation of volatile products in alcoholic fermentation: E. **Kayser** and A. **Demolon.** The amounts of aldehyde, acids, and esters are all modified by access of air to fermenting liquids. The presence of air, therefore, is an essential condition for the production of bouquet in wine.—The anatomy of the human thymus: Henri **Rieffel** and Jacques **Le Mée.** The two lobes of this gland are not united, but are easily separable, at least in the case of newly born infants. The contact of the thymus with the thyroid gland is not exceptional; this contact has been observed in 20 per cent. of the glands examined.—The rudimentary organs of the larvæ of the Muscidæ: J. **Pantel.**—Contribution to the study of the singing voice: M. **Marage.** Curve tracings are given showing the changes taking place in the transition stage between chest and head notes.—The action of ink on the photographic plate: Guillaume **de Fontenay.** A criticism of some experiments by M. Darget.—The treatment of Baleri in the horse by orpiment: A. **Thiroux** and L. **Teppaz.** It is now shown that there are three forms of trypanosomiasis, curable by treatment with orpiment, infesting horses in Gambia, Souma, and Baleri. The diseases caused by *T. congolense* and *T. brucei* still have to be studied from this point of view.—Studies of cancer in mice. The different types of tumours appearing in the same growth: L. **Cuénot** and L. **Mercier.**—An enormous urinary calculus in man: A. **Guépin.** This calculus was removed from a man sixty-eight years of age, measured 8·5 cm. by 6·8 cm. by 4·5 cm., and weighed 220 grams.—The source of the Bise at Thau: MM. **Chevallier** and **Sudry.**

DIARY OF SOCIETIES.

THURSDAY, JANUARY 21.

ROYAL SOCIETY, at 4.30.—Syntonic Wireless Telegraphy; with Specimens of Large Scale Measurements: Sir O. Lodge, F.R.S., and Dr. A. Muirhead, F.R.S.—The Leakage of Helium from Radio-active Minerals: Hon. R. J. Strutt, F.R.S.—The Mobilities of the Ions produced by Röntgen Rays in Gases and Vapours: E. M. Wellisch.—Determination of the Surface Tension of Water by the Method of Jet Vibration: Prof. N. Bohr.—The Photo-electric Fatigue of Zinc, II.: H. Stanley Allen.

LINNEAN SOCIETY, at 8.—The Genus Nototriche, Turcz: Arthur W. Hill.—The Longitudinal Symmetry of Centrospermeæ: Dr. Percy Groom.

ROYAL INSTITUTION, at 3.—Mysteries of Metals: Prof. J. O. Arnold.

INSTITUTION OF MINING AND METALLURGY, at 8.—A Theory of Volcanic Action and Ore Deposits, their Nature and Cause: Hiram W. Hixon.—An Instance of Secondary Impoverishment: H. H. Knox.—The Silver Islet Vein: Walter McDermott.

FRIDAY, JANUARY 22.

ROYAL INSTITUTION, at 9.—The World of Life: as Visualised and Interpreted by Darwinism: Alfred Russel Wallace, O.M., F.R.S.

PHYSICAL SOCIETY, at 5.—The Effective Resistance and Inductance of a Concentric Main, and Methods of Computing the Ber and Bei and Allied Functions: Dr. A. Russell.—(1) The Luminous Efficiency of a Black Body; (2) The Use of the Potentiometer on Alternate Current Circuits: Dr. C. V. Drysdale.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Experiments on a Diesel Engine: W. E. Fisher and E. B. Wood.

MONDAY, JANUARY 25.

ROYAL SOCIETY OF ARTS, at 8.—Electric Power Supply: G. L. Addenbrooke.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—A Proposed North Polar Expedition: Captain Roald Amundsen.

INSTITUTE OF ACTUARIES, at 5.—On an Approximate Method of Valuation of Whole-life Assurances, grouped according to Attained Ages, with Allowance for Selection, on the Basis of O[M] Mortality: E. H. Brown.

TUESDAY, JANUARY 26.

ROYAL INSTITUTION, at 3.—Albinism in Man: Prof. Karl Pearson, F.R.S.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.30.—Annual General Meeting. President's Address: The Relation of Anthropology to Classical Studies: Prof. W. Ridgeway.

MINERALOGICAL SOCIETY, at 8.—On the Identity of Poonahlite with Mesolite: Dr. H. L. Bowman.—Contributions to the Study of Parallel Growths: Dr. S. Kreutz.—Note on the Spontaneous Crystallisation of Solutions in Spherulites: J. Chevalier.—On a Method for Studying the Optical Properties of Crystals: the late Dr. H. C. Sorby, F.R.S.—Some Additional Localities for Idocrase in Cornwall: G. Barrow and H. H. Thomas.—Detrital Andalusite in Tertiary and Post-Tertiary Sand: H. H. Thomas.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further Discussion*: High Speed on Railway-curves: J. W. Spiller.—A Practical Method for the Improvement of Existing Railway-curves: W. H. Shortt.

WEDNESDAY, JANUARY 27.

GEOLOGICAL SOCIETY, at 8.—The Conway Succession: Dr. Gertrude L. Elles.—The Depth and Succession of the Bovey Deposits: A. J. Jukes-Browne.

ROYAL SOCIETY OF ARTS, at 8.—The Part played by Vermin in the Spread of Disease: J. Cantlie.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.

SOCIETY OF DYERS AND COLOURISTS, at 8.—The Locust Bean, and its Practical Application: M. C. Lamb and F. J. Farrell.—Chlorinated Wool: H. P. Pearson.

THURSDAY, JANUARY 28.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Action of the Venom of *Sepedon haemachates* of South Africa: Sir Thomas R. Fraser, F.R.S., and Dr. J. A. Gunn.—The Colours and Pigments of Flowers with Special Reference to Genetics: Miss M. Wheldale.—The Variations in the Pressure and Composition of the Blood in Cholera; and their Bearing on the Success of Hypertonic Saline Transfusion in its Treatment: Prof. Leonard Rogers, I.M.S.—The British Freshwater Phytoplankton, with Special Reference to the Desmid-plankton and the Distribution of British Desmids: W. West and G. S. West.

ROYAL INSTITUTION, at 3.—Mysteries of Metals: Prof. J. O. Arnold.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Parallel Operation of Alternators: Dr. E. Rosenberg.

ROYAL SOCIETY OF ARTS, at 4.30.—Some Phases of Hinduism: Krishna Gobinda Gupta.

FRIDAY, JANUARY 29.

ROYAL INSTITUTION, at 9.—Improvements in Production and Application of Gun-cotton and Nitro-glycerine: Sir Frederick L. Nathan.

SATURDAY, JANUARY 30.

ROYAL INSTITUTION, at 3.—Sight and Seeing: Sir Hubert von Herkomer.

ESSEX FIELD CLUB, at 6 (at Essex Museum of Natural History, Romford Road, Stratford).—Subsidence of Eastern England and Adjacent Areas: W. H. Dalton.—Some Notes on "Moorlog," a Peaty Deposit dredged up in the North Sea: H. Whitehead and H. H. Goodchild.

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